

For all questions, answer E. "NOTA" means "None of these Answers"

- Which of the following has the same reference angle as 22° ?
A) 68° B) 112° C) 202° D) 292° E) NOTA
- Simplify the following: $\frac{\tan(x)\sec(x)(1-\sin^2(x))}{\sin^2(x)\cos(x)\sec(x)}$, for $0 \leq x \leq \frac{P}{2}$
A) $\sec(x)$ B) $\csc(x)$ C) $\sin(x)$ D) $\cos(x)$ E) NOTA
- A plane starts traveling originally in a direction of 29° east of north at 400 mph for 48 minutes. Immediately after these 48 minutes, the plane receives a distress call and proceeds at a new heading of 15° east of south at 580 mph for 1 hour and 27 minutes. The plane then returns to its starting point. Find the total distance traveled to the nearest whole mile. (Note: Assume all courses are linear and the plane change in direction is instantaneous)
A) 1161 B) 1622 C) 1811 D) 1932 E) NOTA
- What is the sum of the period and phase shift of $y=5\cos(5x-p)$.
A) $\frac{3p}{5}$ B) $\frac{p^2+5}{2p}$ C) $\frac{9p}{10}$ D) $\frac{7p}{5}$ E) NOTA
- Given that $\sin f = \frac{x}{\sqrt{x^2+y^2}}$, find $\tan(f)$. (Note: $0 < f < \frac{P}{2}$ and $xy \neq 0$)
A) $\frac{x}{y}$ B) $\frac{y}{x}$ C) $\frac{\sqrt{x^2+y^2}}{x}$ D) $\frac{\sqrt{x^2+y^2}}{y}$ E) NOTA
- What is the range of the secant function?
A) $(-\infty, -1] \cup [1, \infty)$
B) $(-\infty, -1) \cup (1, \infty)$
C) $[-1, 1]$
D) All Real numbers except odd multiples of pi.
E) NOTA

7. Given that \mathbf{p} and \mathbf{q} are vectors, let $\mathbf{p} = 3i + 2j + 5k$ and $\mathbf{q} = -3i - 5j + 6k$. Find $\mathbf{q} \times \mathbf{p}$.

- A) 11 B) $37i - 33j - 9k$ C) $-37i + 33j + 9k$ D) $-9i - 10j + 30k$ E) NOTA

8. An arc length of $\frac{5\mathbf{p}}{3}$ is swept out by the hand of a clock that sweeps through an angle of 60° . Find the length of the clock hand.

- A) $\frac{1}{5}$ B) 5 C) 10 D) 25 E) NOTA

9. Simplify $\frac{(5+2i)(3-6i)}{2+2i}$ to $A + Bi$ form. Find $A + B$ given that $i = \sqrt{-1}$

- A) -12 B) -2 C) 2 D) 12 E) NOTA

10. Evaluate $\lim_{x \rightarrow \infty} \left(\frac{5x^2 + \cos(x) - 6x}{\sin(x) - x^2 + 5} \right)$.

- A) -5 B) $-\frac{1}{5}$ C) Diverges D) Oscillating Limit E) NOTA

11. Find the sum of all solutions for β on $0 \leq \beta \leq 2\pi$: $\cos^2(\mathbf{b}) + \sin(2\mathbf{b}) + \sin^2(\mathbf{b}) = 0$.

- A) 2π B) $\frac{10\mathbf{p}}{7}$ C) 4π D) $\frac{5\mathbf{p}}{2}$ E) NOTA

12. Given the two vectors $\mathbf{p} = i$ and $\mathbf{q} = j$, what direction would $\mathbf{p} \times \mathbf{q}$ point?

- A) $+k$ B) $-k$ C) $i + j$ D) $-i - j$ E) NOTA

13. Evaluate $\lim_{x \rightarrow 0} \left(\frac{\sin(x)}{x} \right)$.

- A) 0 B) 1 C) Oscillates D) D.N.E. E) NOTA

14. Given that $\sin(\mathbf{f}) = A$ and $\cos(\mathbf{g}) = B$, evaluate $\cos(\mathbf{f} - \mathbf{g})$ in terms of “A” and “B”.

(Note: $0 < \mathbf{f} < \frac{\mathbf{P}}{2}$, $0 < \mathbf{g} < \frac{\mathbf{P}}{2}$ and $0 < \mathbf{f} - \mathbf{g} < \frac{\mathbf{P}}{2}$)

A) $\frac{A}{B^2-1} - \frac{B}{A^2-1}$

B) $\frac{A}{B^2-1} + \frac{B}{A^2-1}$

C) $B\sqrt{1-A^2} - A\sqrt{1-B^2}$

D) $A\sqrt{1-B^2} + B\sqrt{1-A^2}$

E) NOTA

15. Find the acute angle formed by the line $3x-5y = 6$ and the y -axis to the nearest degree.

A) 31° B) 32° C) 58° D) 59° E) NOTA

16. Given that a sine wave has a period of 2, find the frequency.

A) $\frac{1}{4}$ B) $\frac{1}{2}$ C) 2 D) 4 E) NOTA

17. Which of the following is/are true for ALL values of x , \mathbf{r} , and \mathbf{d} ?

I. $2\sin(\rho)\cos(\delta) = \sin(\rho+\delta) + \sin(\rho - \delta)$

II. $\tan(\mathbf{r} - \mathbf{d}) = \frac{\tan(\mathbf{d}) - \tan(\mathbf{r})}{1 + \tan(\mathbf{r})\tan(\mathbf{d})}$ for $0 < \mathbf{r} < \frac{\mathbf{P}}{4}$ and $0 < \mathbf{d} < \frac{\mathbf{P}}{4}$

III. $\sin(x) = -\sin(x)$

A) I only C) I & II only
B) II only D) II & III only E) NOTA

18. Given the following set of parametric equations with parameter “ t ” varying from $0 \leq t \leq 2\mathbf{P}$. Find the sum of all the values of “ t ” for which the graph in the xy - plane is tangent to either the x -axis or the y -axis.

$$x = 3 + 3\cos(t)$$

$$y = 2 + 2\sin(t)$$

A) π B) 2π C) $\frac{5\mathbf{P}}{2}$ D) 5π E) NOTA

19. Find the included angle of the two sides of an acute triangle of length 7 and 12, given that the triangle has an area of 21 square units.

- A) 15° B) 22.5° C) 30° D) 60° E) NOTA

20. The circumference of an automobile tire is 48 inches. On a given trip a driver wishes to calculate the number of rotations and then the total number of radians through which the tire rotates. If the distance of the trip is 86 miles, how many radians does the tire rotate through?

- A) $\frac{56760}{P}$ B) 113520 C) 227040π D) Not enough information E) NOTA

21. Given the rectangular coordinates of $(2a, -4a)$, find the polar coordinates. (Round the angle to the nearest whole degree, and $a > 0$)

- A) $(-2a\sqrt{5}, 117^\circ)$
 B) $(2a\sqrt{5}, 117^\circ)$
 C) $(2a\sqrt{5}, 63^\circ)$
 D) $(2\sqrt{5}, 63^\circ)$
 E) NOTA

22. Which of the following is/are always true given that \mathbf{u} and \mathbf{v} are non-zero three-dimensional vectors:

- I) $\mathbf{u} \cdot \mathbf{v} = 0$ if and only \mathbf{u} and \mathbf{v} are orthogonal
 II) $\mathbf{u} \cdot \mathbf{v} = \mathbf{v} \cdot \mathbf{u}$
 III) $\mathbf{u} \times \mathbf{v} = \mathbf{v} \times \mathbf{u}$

- A) I only B) I & II only C) I & III only D) II & III only E) NOTA

23. Evaluate $\lim_{x \rightarrow +\infty} (\text{Arc sec}(x))$

- A) 0 B) $\frac{P}{2}$ C) $\tan(x)$ D) ∞ E) NOTA

